



EUROPEAN PV ASSOCIATIONS' POSITION PAPER ON A FEED-IN TARIFF FOR PHOTOVOLTAIC SOLAR ELECTRICITY

The national European photovoltaic industry associations, the European Photovoltaic Industry Association (EPIA) and the Centre of Photovoltaics in Poland hereby present their common position on a Feed-in Tariff (FiT) for photovoltaic solar electricity in the European Union. This paper discusses the advantages of FiT schemes in the market development of photovoltaics and addresses potential concerns in regarding implementation.

1. Background

It is widely known and accepted by experts that current levels of dependence on fossil fuels are unsustainable. The main driving forces that necessitate a change in our energy consumption patterns include natural resource depletion, climate change, a need for security of supply, lack of access to basic energy services by one third of the world's population and the predicted economic growth of emerging markets (especially in the BRIC countries – namely Brazil, Russia, India and China).

The transition to a sustainable global energy system is one of the largest challenges to face mankind in the coming century. Increased electricity generation from renewable energy sources (RES-e) contributes substantially to the easing of geo-, climate- and energy-political areas of conflict and should therefore be prioritised at all levels - local, national and global.

The European Union has set an ambitious target of 21 % of RES-e in 2010¹, obliging all member states to intensify efforts and reach the common objective. The European Commission's report entitled "The share of renewable energy in the EU" concludes however that: "Only a few member states have until now implemented an attractive framework for renewable energy sources. In view of the meagre results so far the Commission calls on member states to ensure the fulfilment of the 2010 targets by the implementation of appropriate measures" ².

Within various technologies photovoltaics seems to attract considerable attention due to its potential of contributing a major share of renewable energy in coming decades. The most appreciated advantage of this hi-tech innovative technology is its free, abundant and inexhaustible source of energy. A study conducted by the Renewable Energies Unit of the DG-JRC in Ispra³ shows that the entire electricity consumption of EU25 member countries would be satisfied by covering app. 0.71% of their total territory with

1 Initially the target was 22,1% of RES-E for EU15

2 Communication of the European Commission on "The share of renewable energy in the EU", 25 May 2004

M. Suri, T. A. Huld, E. D. Dunlop "Regional differences of the PV electricity production in EU25 countries", http://sunbird.jrc.it/pvgis/pv/doc/other/2004-eupvsec_suri-huld-dunlop_paper.pdf



PV modules. Assuming that installed PV capacity in the EU may increase to that of approximately 200 GWp in 20304, emission of close to 180 Mt of CO2 will be avoided through the deployment of photovoltaic technology alone. Another important advantage of photovoltaics is its high reliability in crisis situations, such as blackouts and natural disasters. In the context of our transition towards a sustainable global energy system, and as a distributed, decentralized form of electricity generation PV therefore constitutes a key technology.

In additition to the objective of decreasing our reliance on fossil fuels through PV electricity, the EU also strives to ensure that the photovoltaic industry remains competitive on the worldwide market. To achieve this complementary goal, effective support mechanisms must be adopted.

Just as in any industry so also in the case of the PV sector, widespread application and therefore increased demand eventually translates into larger economies of production scale which in turn implie lower cost per unit and consumer friendly prices, all of which together ultimately results in attractive returns on investment.

As it is risky to assume that the increase of competitiveness of PV electricity will be ensured by market forces driving the prices for conventional energy to higher levels only, and ultimately favouring alternative energy resources, there is a need to launch support mechanisms aimed at ensuring both:

- 1. Lower inception costs for the investor and
- 2. Adequate gains generated throughout the lifecycle of a PV system regardless of size

Ensuring that these two 'objectives are realized will result in favourable returns for both private users (small investors) and large investors.

The two above-mentioned factors determine the development of the PV market.

One should not underestimate the role of support mechanisms aimed at reducing investment cost in the purchase of PV systems (such as low interest credits/loans, investment subsidies, tax rebates, etc.). However, we believe such measures to be of little use without the basic support of a feed-in tariff for photovoltaic solar electricity (PV electricity) to 'ensure adequate gains throughout the life-cycle of the PV system'.

2. What is a feed-in tariff (FiT)?

A feed-in tariff involves the obligation on the part of a utility to purchase electricity generated by renewable energy producers in its service area at a tariff determined by public authorities and guaranteed for a specific period of time (generally 20 years). A FiT's value represents the full price per kWh received by an independent producer of renewable energy, i.e. including a premium above or additional to the market price, but excluding tax rebates or other production subsidies paid by the government. Different tariffs can be defined for different

technologies (wind, solar, biomass, etc.) or different countries depending on resource conditions (e.g. solar irradiation). The rate of a FiT is furthermore reduced each year for new installations in order to stimulate decrease in production costs.

Historically, feed-in laws have been the primary mechanism used to support RE development in both Europe and the US. They have a track record of some two decades and are well established throughout the European Union. At present, they are being applied in 16 EU member countries.

Whilst many countries in Europe have introduced a FiT on different levels, only some of them (e.g. Germany) have adopted appropriate rates specifically for PV. Others used inadequate FiT parameters (for instance Austria – too low a ceiling on total installed PV capacity) and thus failed to stimulate significant investor interest. In other cases (e.g. Belgium, Slovenia) it is still too early to reflect on the efficiency and effectiveness of FiT programmes. The introduction of a *feed-in tariff* is also being considered beyond Europe (e.g. in Australia, and China). By contrast, there is little practical experience on the efficiency and effectiveness of other relatively new support instruments (e.g. RPS) (see explanatory frame below and section 4.1).

3. Other support schemes

Support schemes to stimulate renewable energy introduction and technology deployment differ greatly among EU member states. It is widely accepted that a vivid research environment and public information campaigns combined with demonstration projects are of major importance for successful market development. In stimulation of PV market growth, a feed-in tariff is the single most important and most successful driver, when applied correctly. Other market support mechanisms, as described below, will merely prove effective as and when all sources of energy (fossil fuels, nuclear energy and RES) reach the same level of competitiveness.

Investment support primarily consists of subsidies, tax facilities or subsidized low-interest rates. These are important support mechanisms as they enable PV market take-off. One should observe that investment support is important for relatively expensive technology and is used in many countries all over Europe.

Quota scheme or Renewable Portfolio Standard (RPS) - a requirement for electricity producers or retail suppliers to source a minimum percentage of their electricity consumption from eligible renewable sources. An RPS is usually combined with a **Tradable Green Certificate (TGC)** system, which is based on open market competition that is hence inherently price sensitive. These certificates have an economic value generating an extra income for RE electricity producers.

Tendering (or bidding) scheme – a variation of FiT and RPS; under an RES-e tendering system, the government awards power purchase contracts by way of tenders for a certain aggregate volume of eligible RES-e to project developers who submit the lowest asking price for a kWh.

4. Why a Feed-in tariff?

This position paper, as a voice for the European PV industry, is intended as an important contribution to the European debate on the future of support systems for the promotion of electricity from renewable energy sources, and photovoltaic solar electricity in particular. Discussing the advantages of FiT schemes and addressing potential concerns of implementation, the position is thus intended to be a useful tool for the European Commission, which is to present an evaluation report on RES support mechanisms by 27th October 2005 and may propose a relevant Community framework. Finally, this common position hopes to be a tool also for national legislators.

4.1 Effectiveness in terms of capacity expansion and RES-E production growth (comparative overview)

Countries with feed-in tariffs for wind power (e.g. Germany, Spain, Denmark) have seen the largest growth of RES electricity. After the Electricity Feed-in Law (EEG) was passed in Germany, installed capacity of wind energy more than doubled year-on-year during the 1990-95 period. At the same time, a viable RES-E manufacturing industry was being established in these countries. The adequate FIT also significantly contributed to surpassing capacity targets. This was the case in both Denmark and Germany, where targets set for the future were reached years in advance with regard to wind.

The German case is also a good example of the FiT effect on installed PV capacity. Although the "100,000 Rooftop Programme" did contribute to the enhancement of installed PV capacity, it was the FiT introduction and later optimisation of its rate that really enabled market take-off, as shown in Fig. 1.

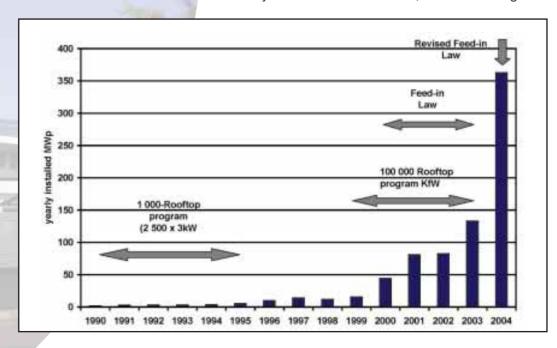


Fig. 1. Market pull by the "100,000 Rooftop Programme" and FiT in Germany (Source: EPIA)

Until 2004 yearly installed PV power increased almost thirtyfold to 363 MW and system price decreased by more than 20% since 1999. During this period German PV industry created about 10,000 jobs in production, installation, trade and maintenance of PV systems. It is also interesting to note that since 1999 the majority of investments in solar cell production facilities in Europe were made in Germany and Spain, the two countries that offer the most stable and realistic legal framework conditions for citizens investing in a PV system⁵.

Competitive bidding systems (e.g. applied in the UK) in contrast are not as effective in building RES-E capacity. In the past (2001) for instance Germany boasted over 8000 MW of installed wind power capacity whereas the UK showed a mere 500 MW despite a much more favourable wind regime.

Another support mechanism – renewable portfolio standard, is unlikely to have comparable impact on PV deployment as the FiT scheme and may even cause unforeseen negative implications. This arises because an RPS requirement for renewable energy may encourage the lowest direct cost for renewable energy options, so as to minimize electricity retail price. Without specific targets for PV, any portfolio standard will stifle growth of PV markets and impede the technology development.

Green certificate systems are not suitable for PV either as the Danish and Swedish cases clearly demonstrate. In Denmark, a forced transition from the FiT scheme to a green certificate system has led to a collapse of the Danish wind energy market (acc. to the WWEA⁶). In 2000, 600 MW of new capacity were installed based on FiT, whereas during the first half of 2001 new installations dropped to a mere 18 MW, bringing construction of wind power plants to an almost standstill.

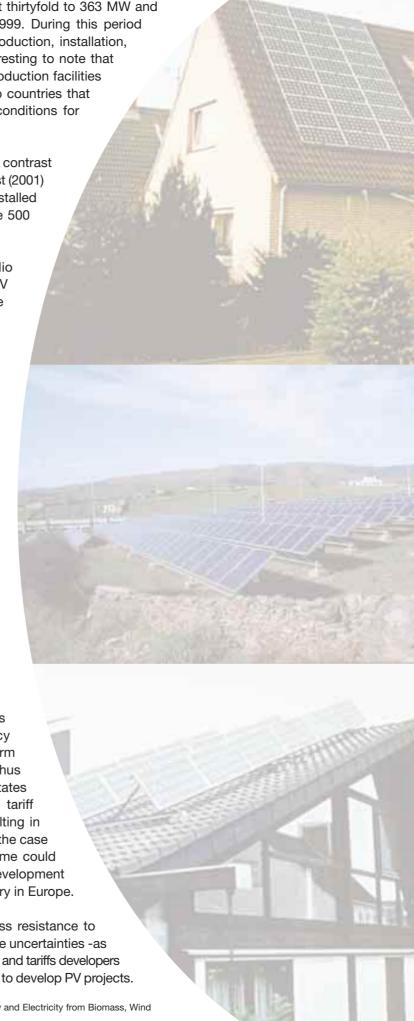
4.2 High level of investment confidence to independent (risk-averse) producers of renewable electricity

Investors in renewable energy technology applications demand stable, durable and predictable policy frameworks, some 15 - 20 years ahead. Long-term stability of income provided by the FiT scheme thus enables long term investment planning and facilitates access to low interest credit and loans. A feed-in tariff proves effective in stimulating new investments, resulting in the augmentation of RES-E installed capacity. As was the case for the wind industry, the application of the FiT scheme could once again prove to be highly effective in the rapid development of a pan European PV market and an innovative industry in Europe.

Tradable Green Certificates in contrast offer much less resistance to entrepreneurial risk. Competitive bidding systems create uncertainties -as tendering processes generally include uncertain timescales and tariffs developers are unsure of whether they will be successful in their bids to develop PV projects.

5 A. Jäger-Waldau et al., "Status Report 2004 – Energy End-Use Efficiency and Electricity from Biomass, Wind and Photovoltaics in the European Union", 2004 EC EUR 21297 EN

6 World Wind Energy Association



4.3 Energy generation cost competitiveness in the longer term

If one agrees that photovoltaics is an energy technology which will significantly contribute to the future energy production due to its efficient conversion of abundant solar radiation and low environmental impact, then it is necessary to consider the point in time when PV will become competitive. The figure below presents the answer to that important question.

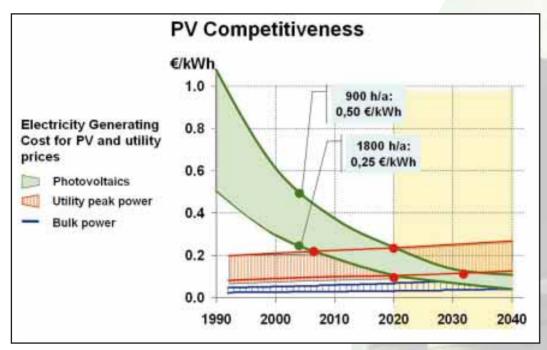


Fig. 2. PV Competitiveness (Source: W. Hoffmann "Towards an Effective European Industrial Policy for PV Solar Electricity")

The market segment "grid connected systems" will be competitive, when PV electricity generating costs based on private investments are lower compared to utility prices in a liberalised market. This will most likely happen as most PV generated kWh are produced in peak hour time and future electricity bills will charge higher prices during peak times compared to the standard flat rate. Fig. 3 shows a respective correlation between (a) spot market prices at the Amsterdam (APX) as well as European (EEX) Power Exchanges and (b) the power output of PV roof top systems installed in Germany (June 2001). It clearly presents that photovoltaic solar electricity is produced at the highest demand when conventional electricity prices are also the highest.

It is estimated that competitiveness of solar photovoltaic electricity for peak power price rates will be reached around 2015 in regions with higher irradiation (e.g. southern Europe) while for Central Europe one should add another 10 years. Competition with bulk power is projected to require 10 additional years for both regions⁷.

Some critics say that even in the longer term the FiT system tends to be costly and may become hard to sustain. This is hardly a convincing argument as the PV market potential is enormous, assuming a swift and successful introduction of FiT on a wide-scale in the whole European Union, as illustrated on Fig. 4.

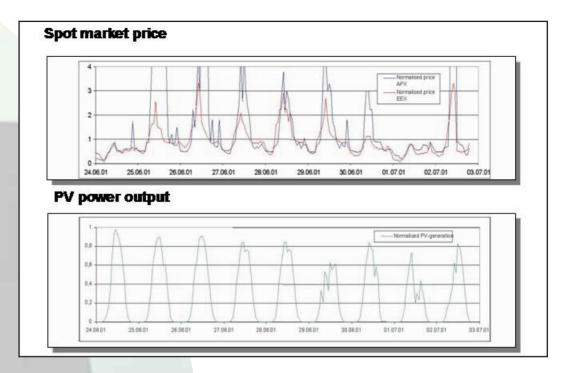


Fig. 3. Spot Market prices in correlation with PV electricity generation in Germany (Source: FhG-ISE)

Assuming that a FiT is coupled to the annual sun hours of a respective region in Europe but otherwise similar to the German EEG (20 years payment, 5% decrease p.a.) one can calculate the total amount of resources required for the next 20 years when the system will expire due to solar PV electricity 'breaking even' also in the grid connected market segment and the phasing out of the 20 years period during which the FiT gets paid for newly installed systems.

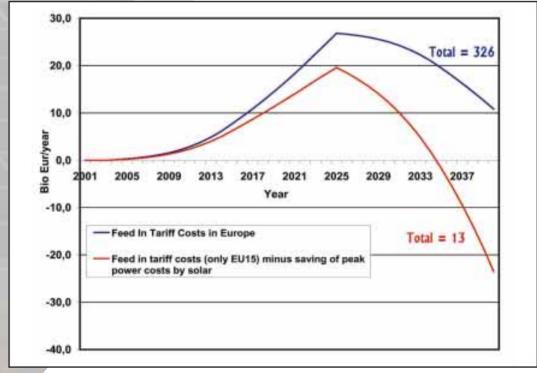
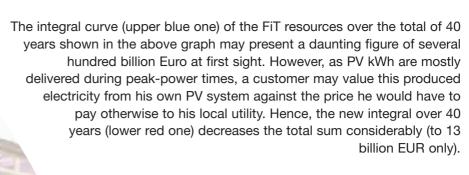


Fig. 4. Costs of FiT implementation in the whole Europe (Source: W. Hoffmann "Towards an Effective European Industrial Policy for PV Solar Electricity")



Adding job creation⁸, necessary investments into production equipment⁹, tax revenue from sold goods such as wafers, cells and modules¹⁰ and without further consideration of the socio-economic value of producing pollution free electricity, one can safely conclude that over the 40 years duration of an assumed feed-in tariff there is a well balanced budget of money collected from all electricity users which is distributed amongst investors in PV systems and the political-economic benefit as described above¹¹.

Further criticism with regard to the feed-in tariff claims it to be inefficient in ensuring that electricity is generated and sold at minimum costs. However, as different companies will compete on the market to sell their products, this will ensure price decrease of the system. Additionally, annual tariff decrease for new PV installations will favour cost efficiency. This in turn will lead to price reductions in PV generated electricity. However, as this process will take time, at present only a feed-in model can create a secure future market for "less cost-competitive" technologies like PV.

Besides, competitiveness of photovoltaic solar electricity will be reached faster because of increasing prices for conventional electricity in the middle to long-term.

4.4 Independence from state budgets

A FiT, unlike investment subsidies, tax rebates etc. does not create burdens on the state budget and as such will gain political acceptance more easily.

The costs of a FiT are borne by electricity consumers. Therefore, proper information and consultation measures (preferably combined with demonstration activities) should be taken to raise environmental awareness and gain consumer approval of the FiT application. European Commission impact studies have shown that a majority of the European population (EU-15) is ready to accept an increase of their electricity bill, if related to renewable energy¹². This willingness to pay more may, however, vary from country to country. The German experience shows that the real cost charged from a household using PV electricity may be low (in 2003 it was as little as one additional Euro per month)¹³. This goes hand in hand with a conviction of the imperative to increase solar energy's role in ensuring future energy security, expressed by German citizens in 2004 opinion polls¹⁴.

- 8 An Epia/Greenpeace study projects 100 000 PV jobs by 2010 and 2 million jobs by 2020 in Europe (Renewable Energy World, v.7, nr 6, 2004, p.106)
- 9 about 6 billion Euro until 2010, 30 billion Euro until 2020 and more than 200 billion Euro until 2030; see the footnote 6
- 0 1,12 billion Euro in 2010, 4,8 billion Euro in 2020 and 32 billion Euro in 2030; ibidem (assumption of a 16% VAT)
- 11 ibidem
- 2 EORG report "Energy: Issues, Options and Technologies Science and Society"; http://europa.eu.int/comm/research/energy/pdf/eurobarometer_energy_en.pdf
- 3 "Solar Generation" Greenpeace and Epia's Report, 2004
- 14 According to Allensbach Institute 2004, http://www.ifd-allensbach.de/index.html

4.5 Low and simple administration demands

From a consumer point of view the FiT is a clear and easily understandable mechanism. The one-page text of the EEG was one of the shortest and simplest laws implemented in Germany. Tendering and RPS schemes by contrast are more complex to implement. Besides, administration costs of a FiT are usually lower than for the implementation of a national trading scheme (TGCs). This fact is especially important for small countries where a competitive national trading scheme is difficult to implement. Even in Sweden, energy utilities are refraining from trade of certificates in expectation of the creation of a larger, more liquid and lucrative, pan-Nordic market for certificates.

4.6 Encouragement of technological development and high quality

This process is stimulated through the application of an annual decrease in FiT rate for new installations. Producers with lower turnover aim at improving their efficiency through technology development to stay competitive on the market. This is also important with regard to competitiveness of European production companies, since a FiT supports them by stimulating demand in the changing macroeconomic environment.

4.7 Accessibility

A FiT appears to be the most democratic support mechanism, since it is more likely to appeal also to small investors. Participation in FiT schemes is open to any system installed, regardless of its energy generation volume. In case of an RPS combined with green certificates, by contrast, larger generators are more willing to risk selling electricity and certificates under uncertain conditions. Critics point out that TGC schemes obliterate small, decentralised RES-E generation, since it is designed for a different target group: utilities, banks, pension funds, etc.¹⁵

As far as tendering schemes are concerned, the intense price competition among renewable energy suppliers favours large RE developers and suppliers who are able to reduce cost and thus offer lower prices.

Feed-in-tariffs are therefore the most effective mechanism with regard to a number of potential beneficiaries. Practice has proven that FiT create superior conditions for small and medium investors and offer improved grounds for economic development.

5. Why government support is crucial in accelerating the development of PV-specific green power schemes.

State's role

As experience shows, governments do have a vital role to play in both establishing a realistic and supportive policy framework, and in accelerating the development of PV-specific green power schemes.



The issue of the decisive role of state in FiT introduction has been examined by the European Court and thus has legal precedence. In 2001 this institution declared that the German feed-in law was compatible with EU law.

State intervention for renewable energies is also justified given a twofold obstacle they are facing in the domestic electricity market:

1) Externalities not always adequately included in the cost of conventional energy

The electricity wholesale price reflects an incomplete picture of the real, external and internal production cost. As it does not take into account the cost of pollution control inherent in the use of fossil fuels, it prevents the environmental benefits from being considered at face value, and thus denies renewable energy sources the widely acclaimed competitive advantages they were developed to provide in the first place.

Therefore public intervention may be fully justified by the imperative to take into account external costs related to the environment (not fully included in the cost of electricity produced from fossil fuels), leading to a level playing field on the market and to stimulate technological change.

2) PV markets and technologies are in its infancy – they need support to become sustainable As renewable energy technologies like photovoltaics are not completely mature, they cannot enter into direct competition on the market with conventional technologies. Without the widespread dissemination of a technological learning process and economies of scale to occur properly, these technologies cannot aim to be competitive.

FiT vs. free electricity market

There is an issue that is being heavily discussed: as a national system of feed-in tariff is available only to domestic generators of green electricity it excludes imports of renewable electricity. This situation may be in conflict with the EU rules regarding nondiscrimination of domestic versus foreign producers and free international trade among member states. On the other hand, non-discrimination of producers and free international trade may lead to major imports of green electricity and major outflows of financial resources, which may be unacceptable for a country offering relatively high feed-in tariffs¹⁶. In the Community Guidelines on State Aid for Environmental Protection it is stated that state aid for renewables should result in an overall increase of renewable energy sources and not in shifts from one member state with less favourable RE incentives to another with more favourable state aid.

CONCLUSIONS

Comparing the performance of different support mechanisms applied to RES-E market development one can conclude that a feed-in tariff is at present the best support proposal for the PV market. In the future, when this

market is well developed, other mechanisms (e.g. net metering) may prove more suitable. However, at the present stage of PV development in Europe, only a feed-in model can create a secure future market for today's "less cost-competitive" technologies such as PV. And only a model based on guaranteed feed-in tariffs enables a quick and broad implementation of renewable energy, better supports its technological development, as well as more efficiently promotes cost reduction¹⁷.

The report produced in 2001 for the EU, based on the ElGreen computer model which reviews all options for supporting RES-E systems comes down on the side of a FiT scheme. It has been successful for triggering substantial dissemination in most of the countries where it has been introduced. It has proven to be the preferable national instrument for significant development of RES-E. The major advantage of a feed-in tariff is that it is effective, flexible, fast and easy to establish (and to adapt if there are difficulties)¹⁸.

However, FiT criticism and improper applications are also a reality. Therefore this particular support instrument should be very carefully designed. As past experience shows administrative burdens should be removed and low ceilings of total system power avoided (consider Spanish and Austrian cases). There is also a need for a favourable legal and administrative framework (e.g. building regulations, grid access-related procedures). Hence, a successful feed-in policy includes the following design features:

- long-term contracts (15-20 years),
- guaranteed price that offers reasonable rates of return for producers, easing access to financing sources (e.g. preferential credit lines) due to clear payback periods,
- integration into long-term planning with other policy options (i.e. investment conditions),
- annual rate decrease according to technological progress for newly installed systems,
- independence from state budgets,
- simple structure,
- low administrative costs and demands,
- supportive in the changing macroeconomic environment (e.g. currency exchange rate).

Considering large investments needed to establish photovoltaic solar electricity in energy systems, it must become a magnet for private capital. Long-term stability of income is a pre-condition to attract investors in long-term investments such as RE power plants. Thus, long-term power purchase agreements guaranteed by a feed-in-tariff are a suitable means at the present stage of PV market development in Europe.

Implementation of a feed-in tariff for photovoltaic solar electricity is a necessity to significantly increase the deployment of PV in Europe!

We recommend the establishment of task-forces to prepare necessary legislative measures.

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